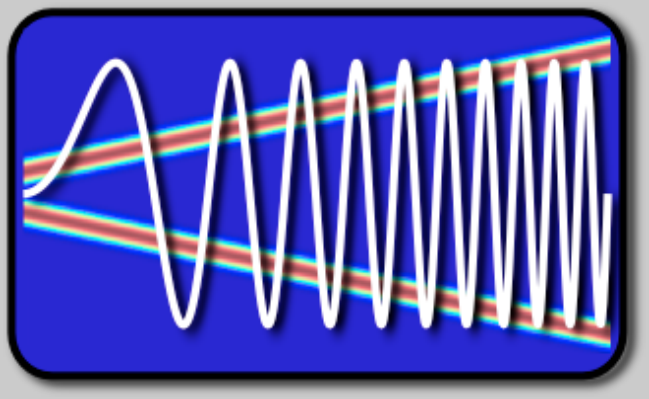
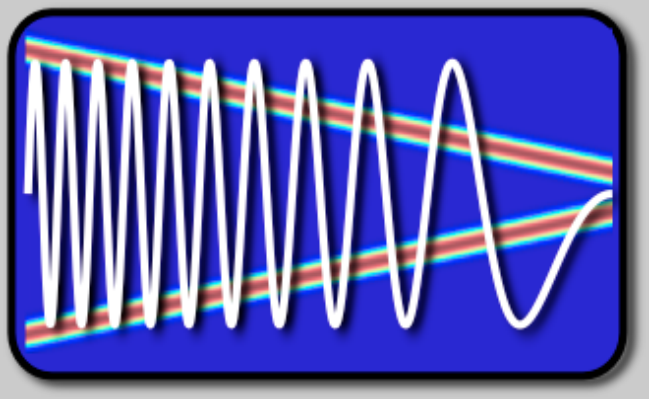


EE123 Digital Signal Processing

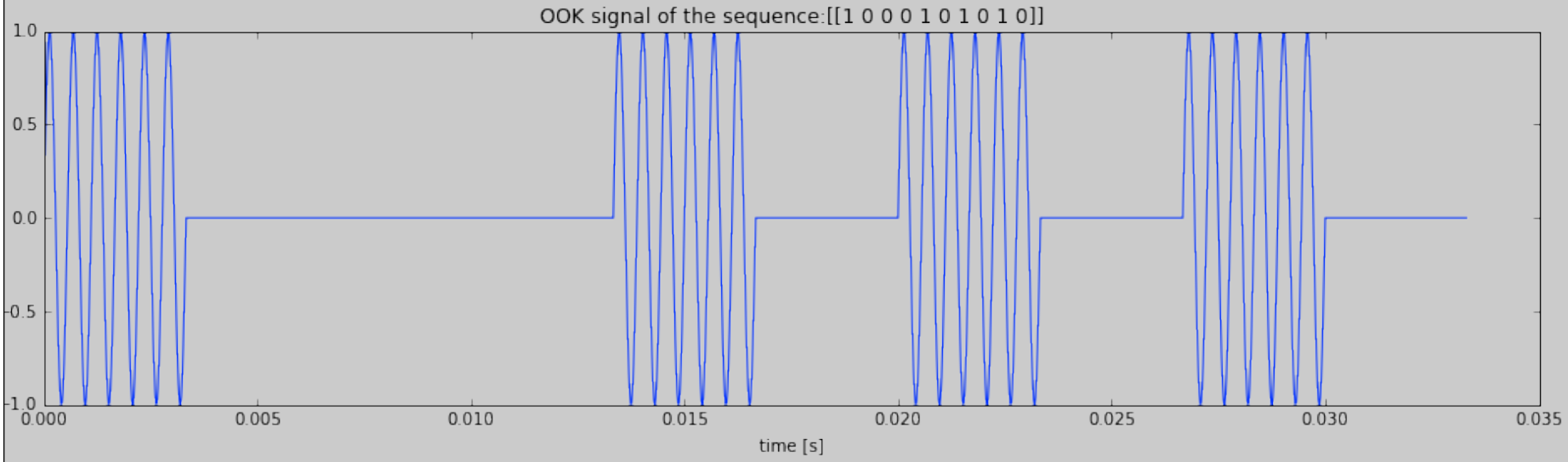


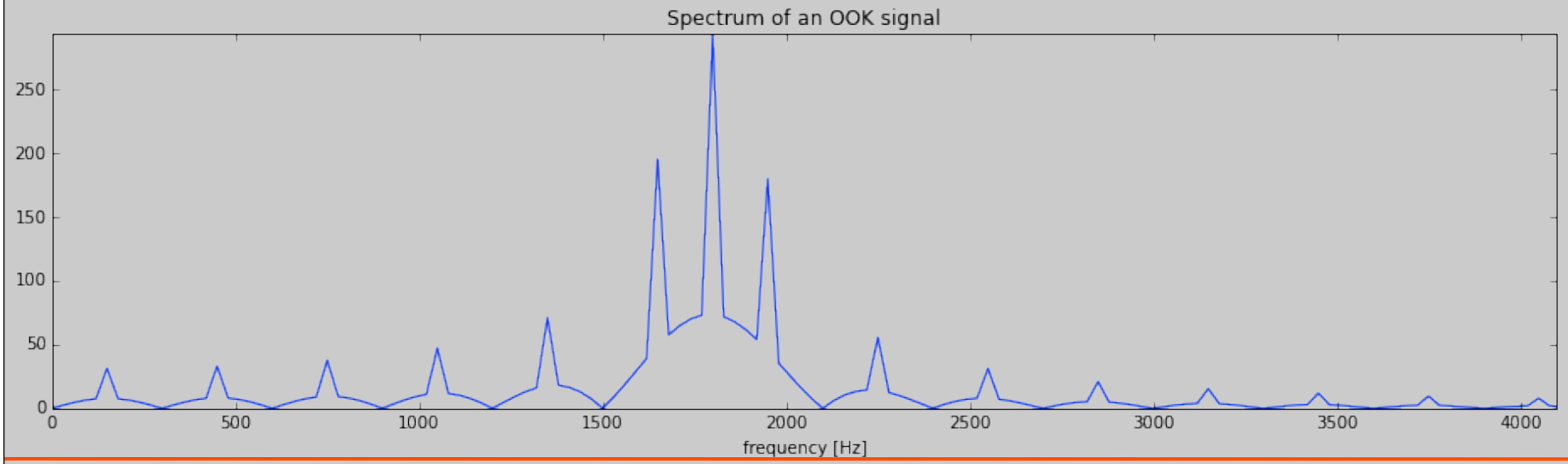
Lecture 30
Lab 6 and
Generalized Linear Phase

M. Lustig, EECS UC Berkeley

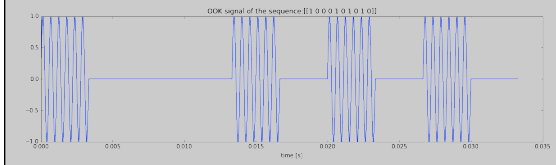
Lab6 - Prelab: Digital Communication

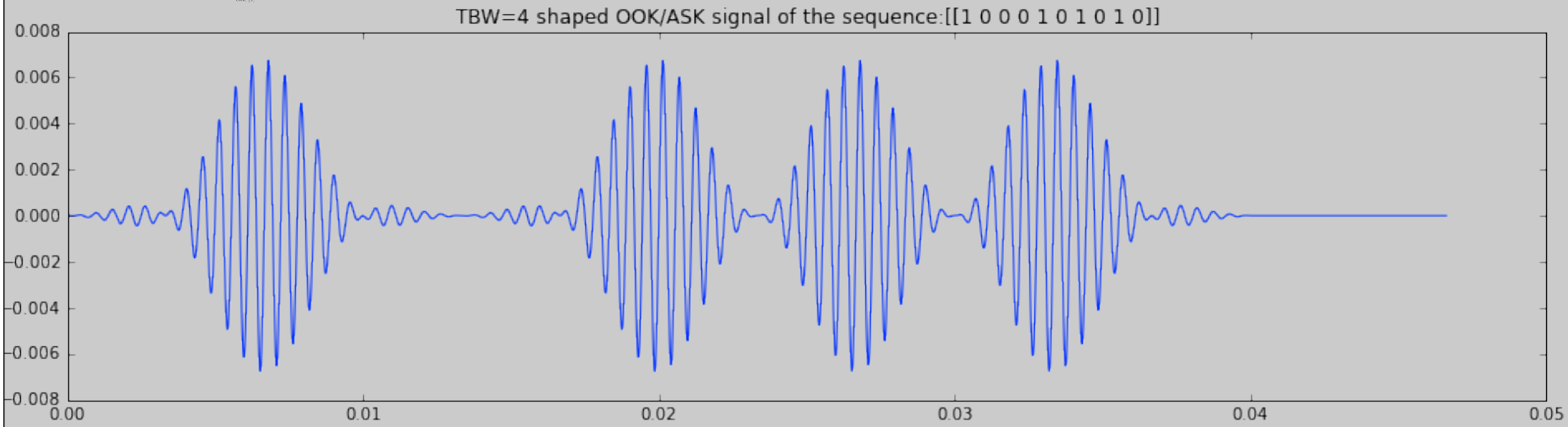
- Amplitude Shift Keying

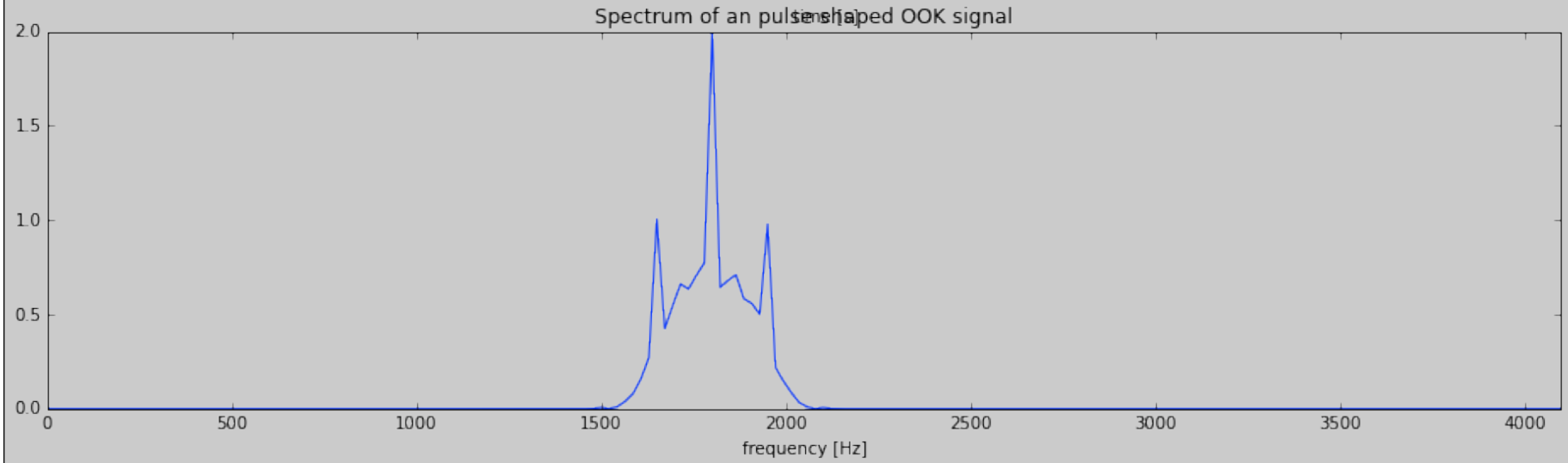




Pulse Shaping to Reduce Sidebands

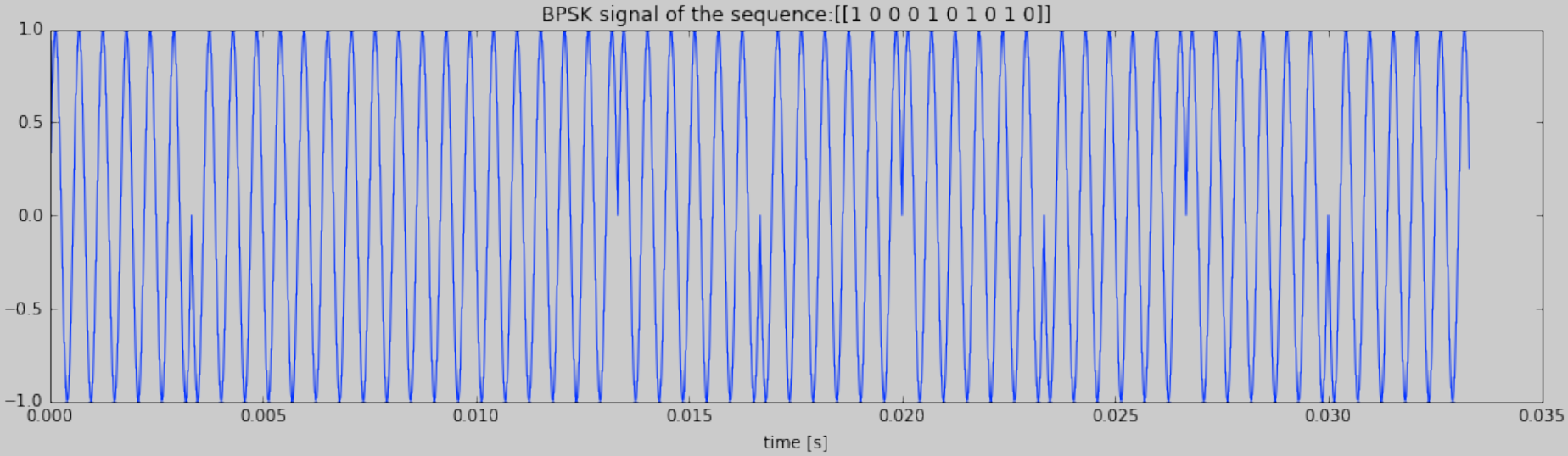


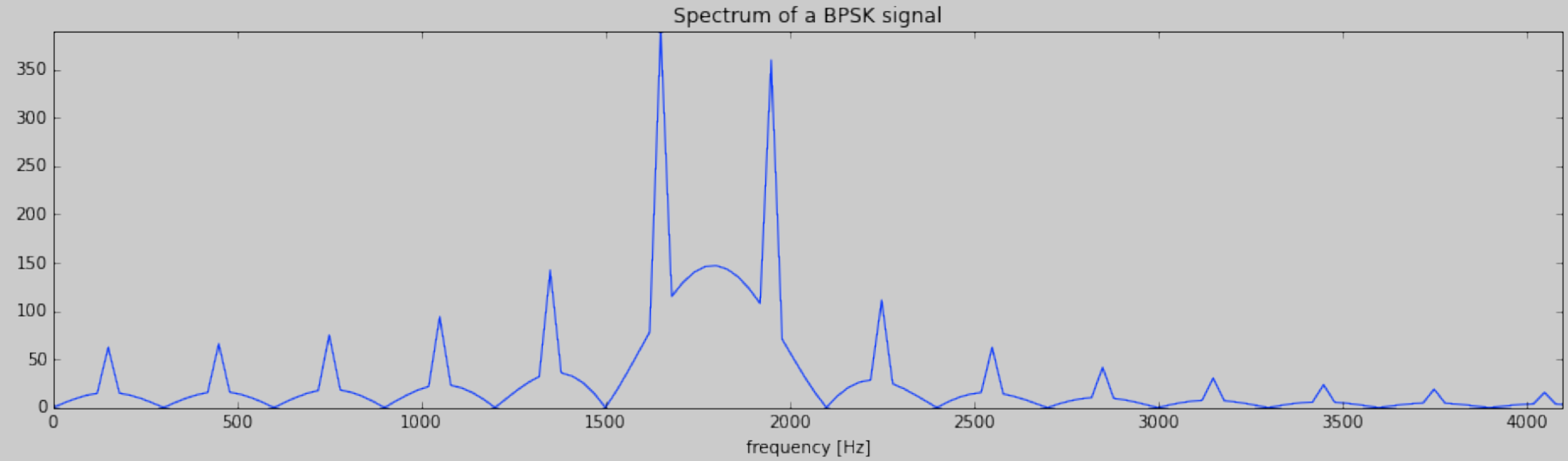




- Narrow band, but inter-symbol interference!

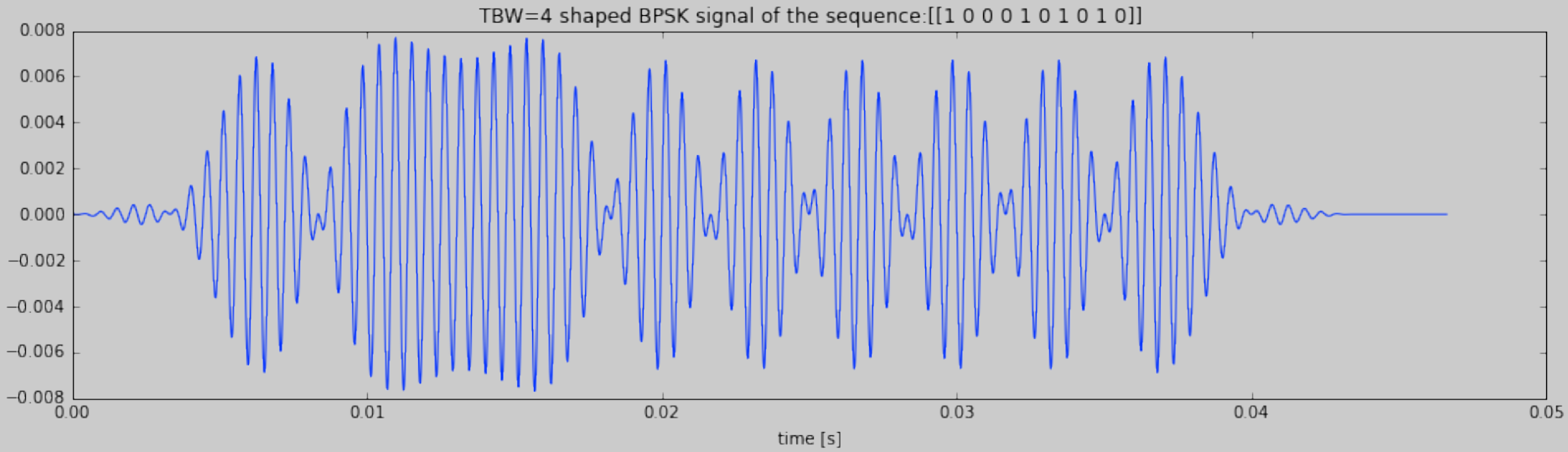
Phase Shift Keying

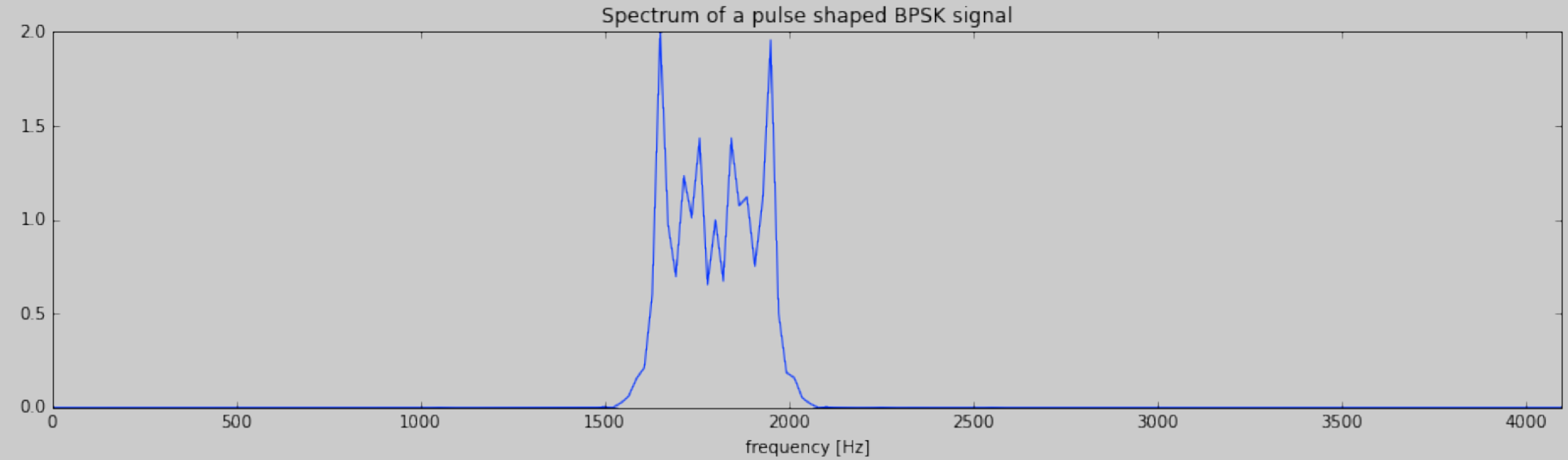




- Lots of sidelobes, but constant envelope!

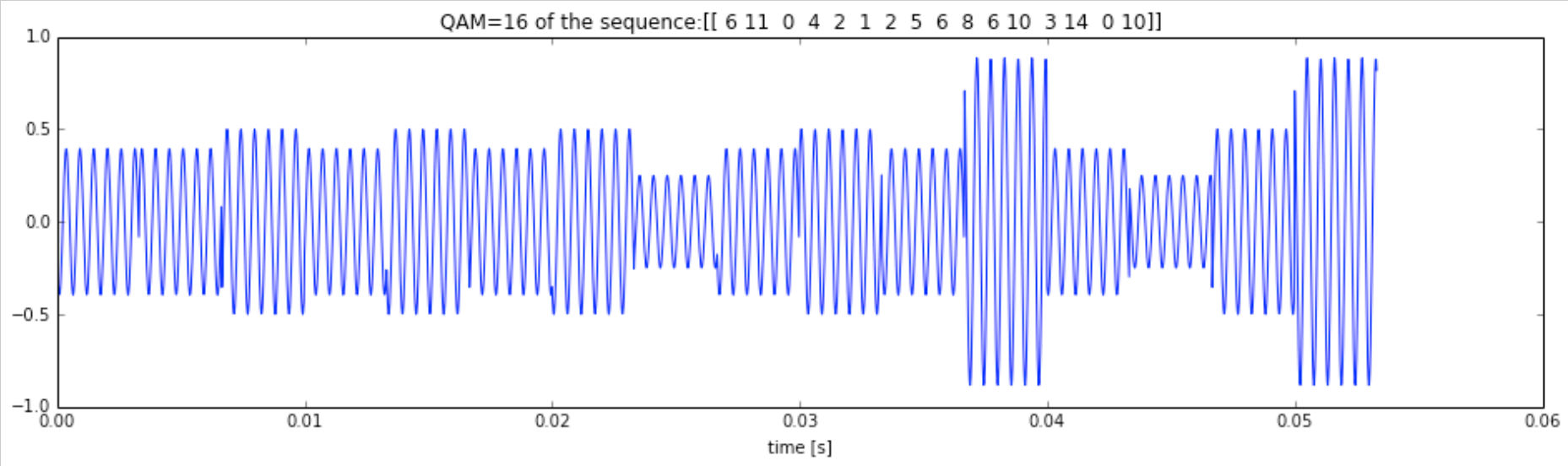
Pulse Shaping

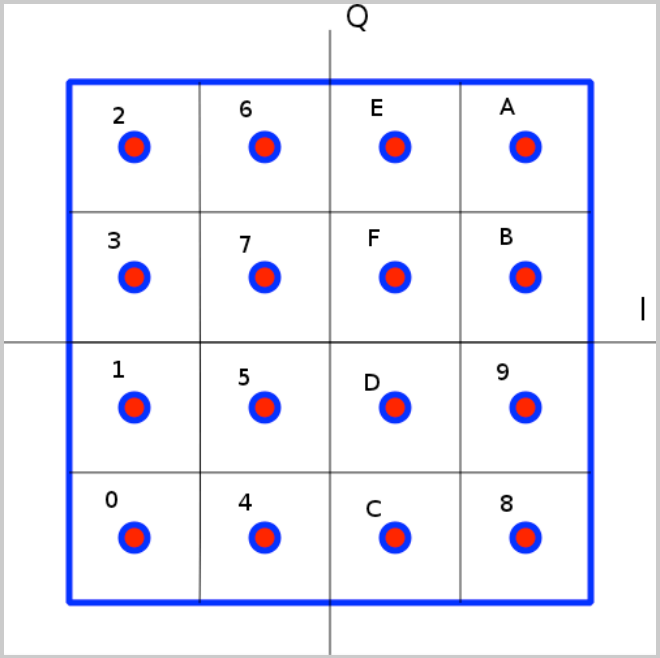




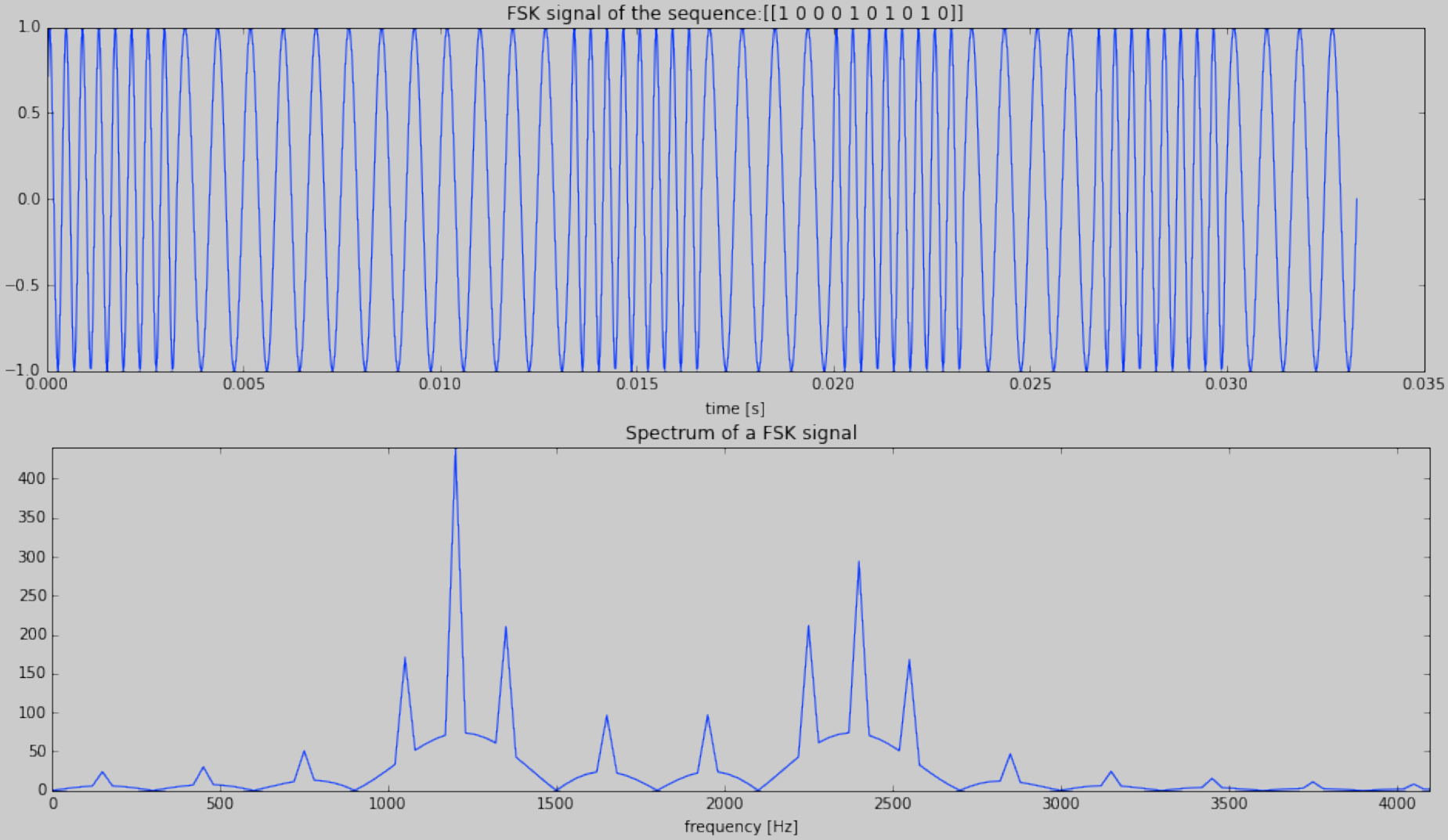
- Lost the sidelobes, but not constant envelope!

Quadrature Amplitude Modulation(QAM)



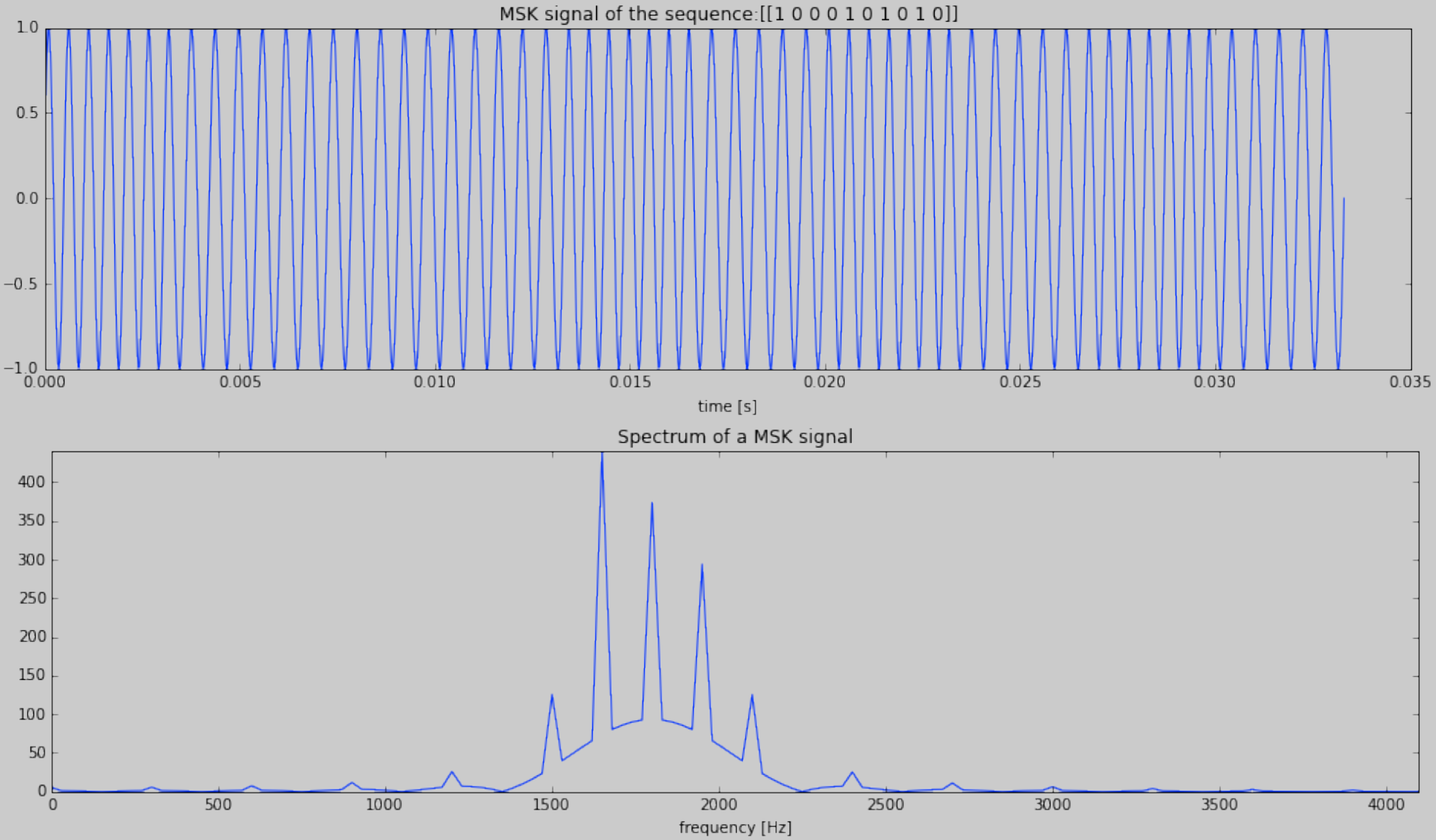


Frequency Shift Keying



- 1200Hz/2400Hz 300 baud. 4/8 cycles/bit
- Constant envelope, wide band

Minimum Shift Keying (MSK)



- 1200Hz/2400Hz 2400 baud. 0.5/1 cycles/bit
- Much more narrow-band

Lab 6 Part A - Audio FSK

- In part A, the lab implements a modem for packet based tranciever
- In Part B you will use the modem for implementing APRS
- You will be able to send/receive packet to other classmates
- You will be able to send/receive APRS packets that users and stations with APRS equipped radios can decode.

AFSK1200 / Bell 202 modem

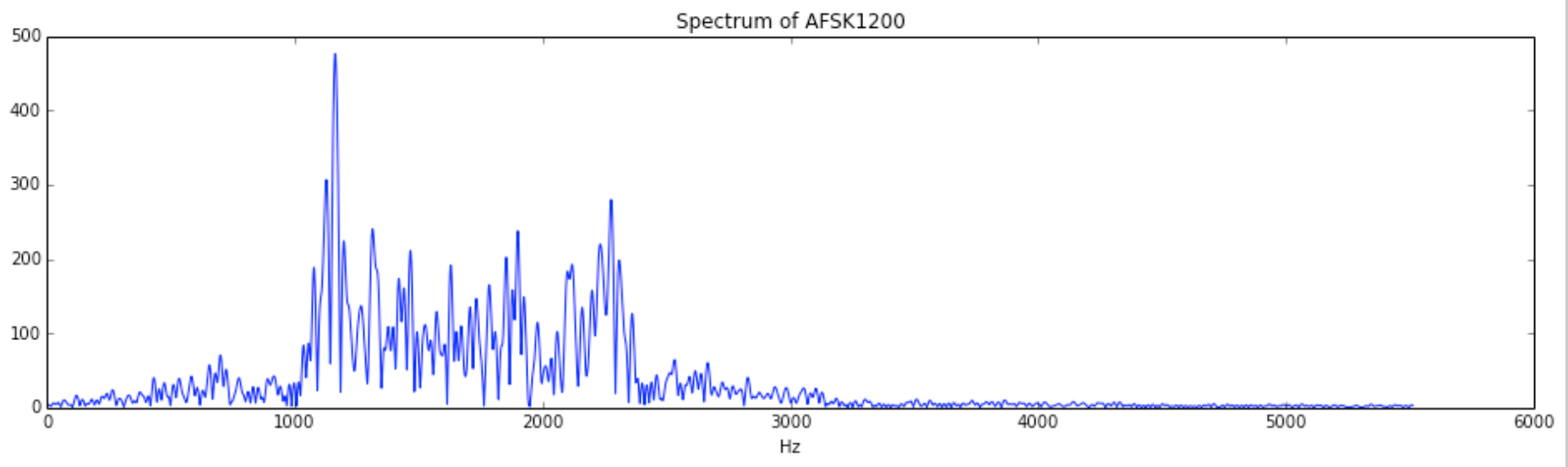
- Audio FSK
  - Encodes digital data at 1200b/s
  - Use audio frequencies 1200/2200Hz
  - Within the bandwidth of the audio input BP filter of your radios
  - Still(!) popular for ham packet networks

$$s(t) = cos\left(2\pi f_c t + 2\pi\Delta f \int_{\infty}^{t} m(\tau)d\tau\right)$$

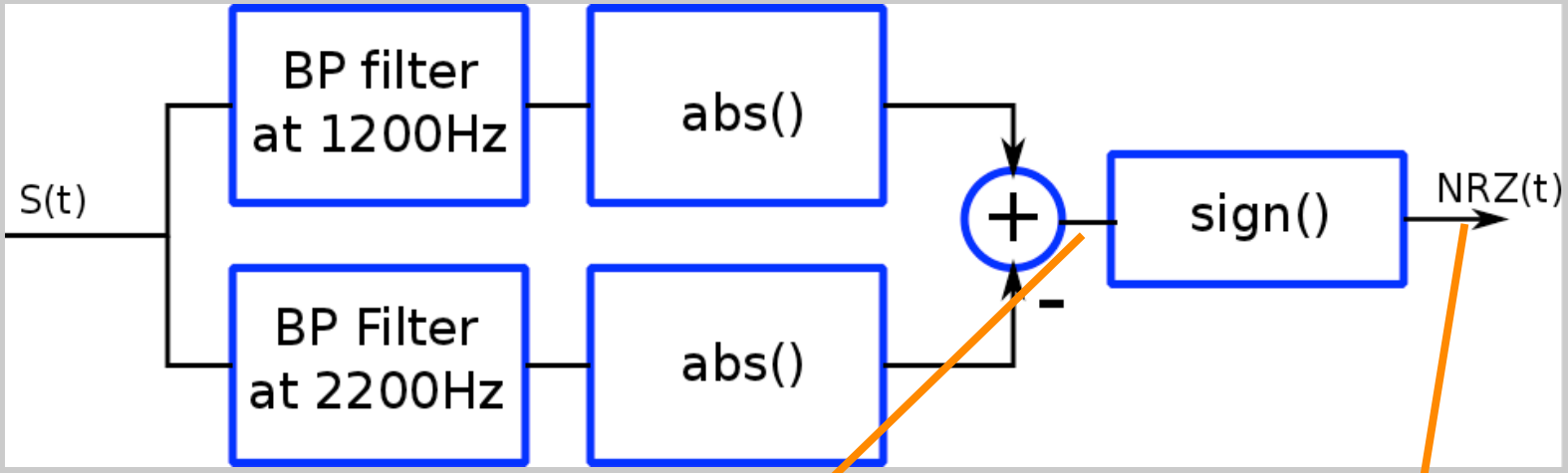
  - fc = 1700, $\triangle$f = 500, m(t) = ± 1
  - Phase is not the same for each bit -- must use non coherent detection.

AFSK1200

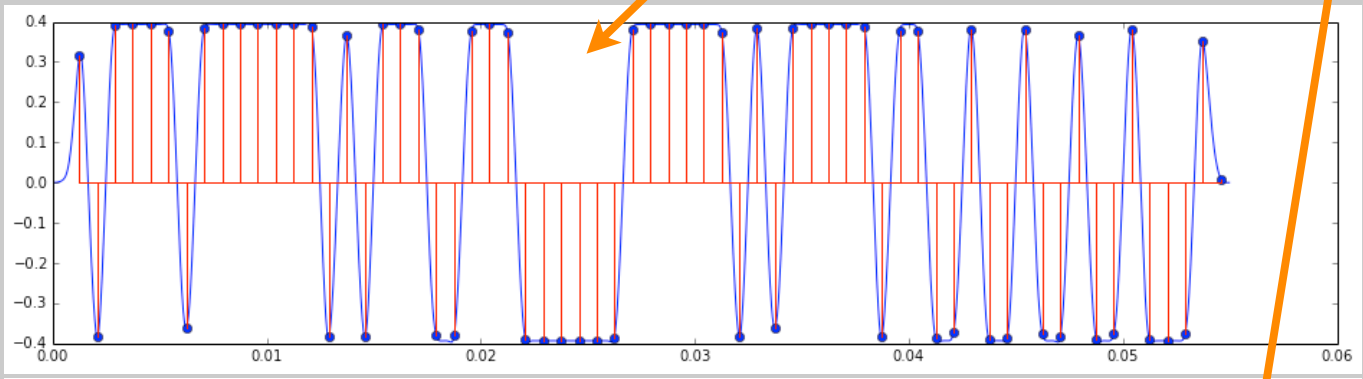
- Write a function to generate AFSK1200
  - Take care: sampling rate (44.1KHz) does not divide with bit-rate
  - Look at Spectrum

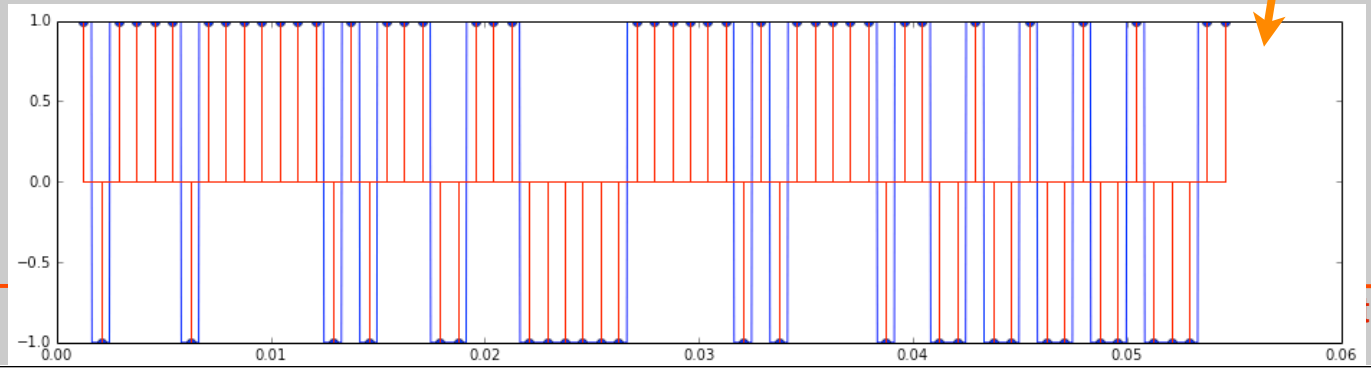


Non-Coherent Demodulator

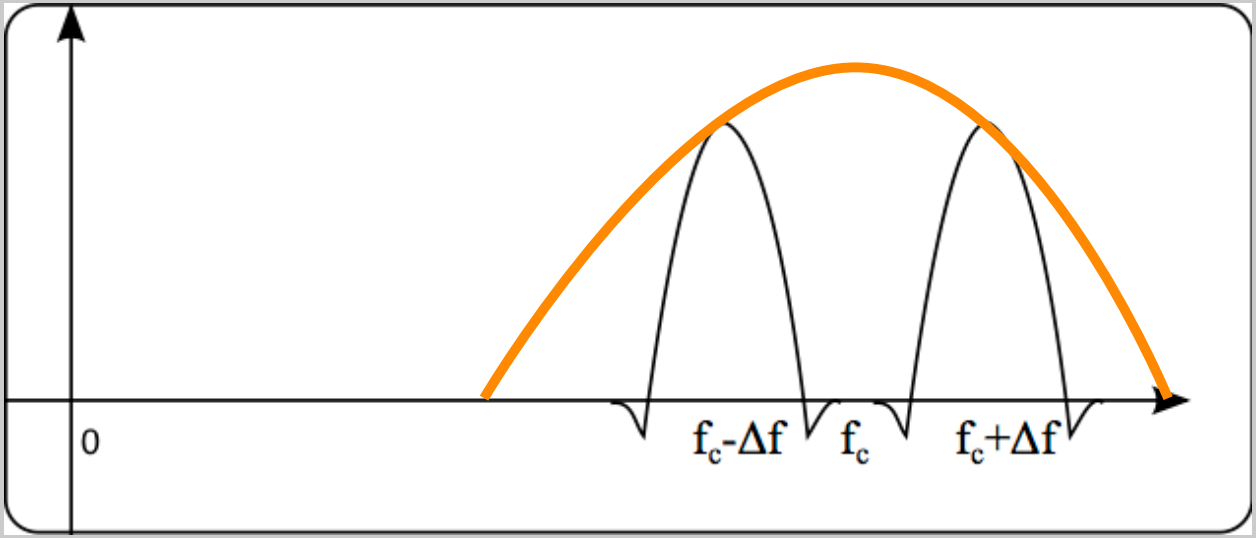


- Complex BP filters around frequencies





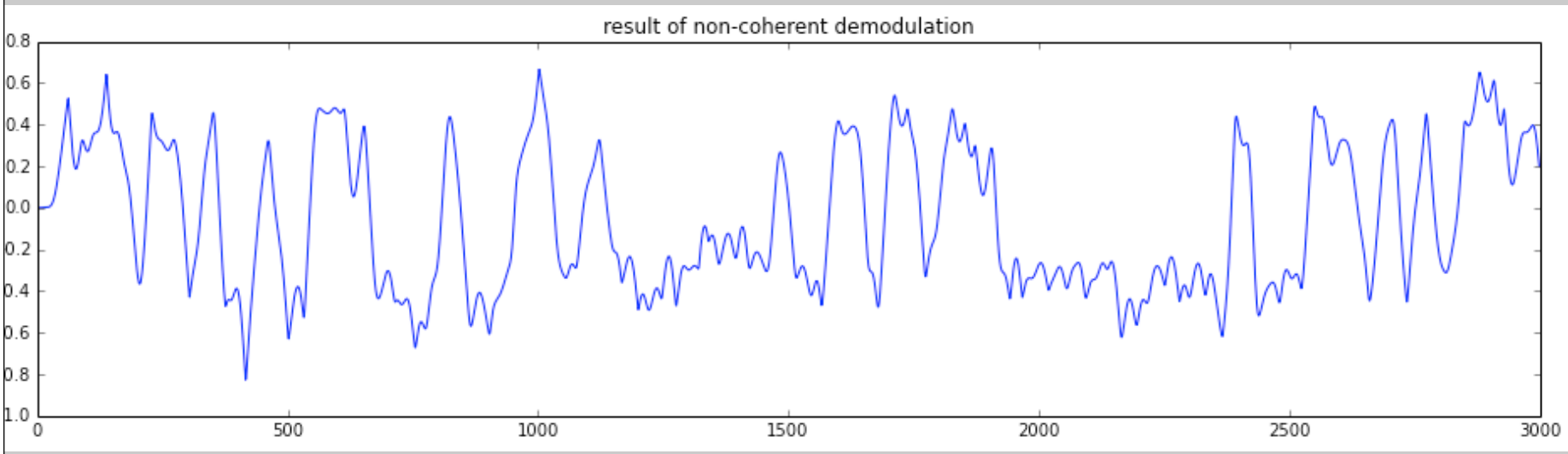
FM Demodulator



- Complex bandpass filter
- Compute Phase derivative to get frequency
- Low-pass filter again with a BW of 1200hz corresponding to bit rate

Bit Error Rate

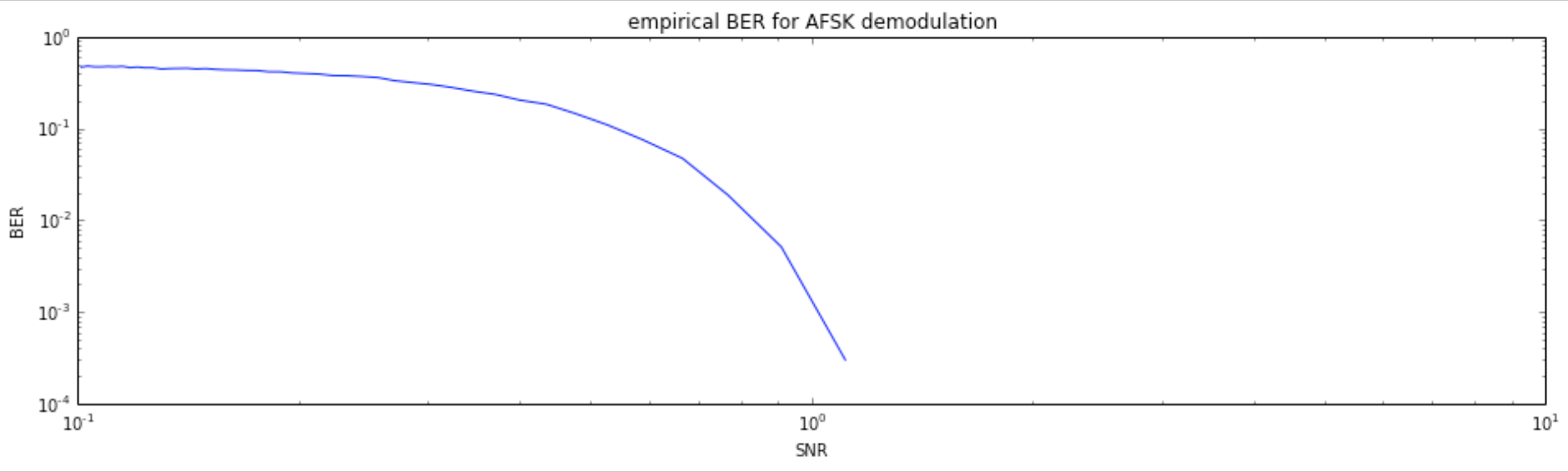
- When adding noise, things are not so nice



- Compute % of bits incorrectly decoded with respect to total bit sent.
- `'BER of non-coherent:', 0.0021 in this case`

Bit Error Rate Curves

- Compute BER vs SNR



- Compare between parameters and methods.